Colonial Muscular System.—Besides the muscular cords just mentioned, there exist in the common transparent substance muscular bands which are by no means so well defined, and which unite the individuals to one another in the longitudinal direction. Panceri has described their course with considerable exactitude, but without knowing their origin. These muscular bundles originate in the transparent substance itself, in which we see them diverging at certain points; and they seem to be formed at the expense of the actual cells of this substance modified in a peculiar manner. The normal constituent cells of the common transparent substance are stellate.

On the Elæoblast.—Salensky has endeavoured to show that the elæoblast of the *Salpæ* may be the altered representative of the tail of the *Appendiculariæ* and the tadpole-larvæ of Ascidians. As regards *Pyrosoma*, this hypothesis is inadmissible. The elæoblast, in fact, acquires in *Pyrosoma* the form of a ring surrounding the germinative extremity of the endostyle. It is therefore no longer a simple organ as in the *Salpæ*. By its form and relations it cannot represent the tail of the *Appendiculariæ*.

Its function appears rather to be physiological. It enlarges so long as the bud remains attached to the parent, and diminishes from the moment when separation is effected, until that in which the young ascidiozoid, being brought into communication with the outer world, can live on its own account; it then disappears altogether. I do not think it plays any part, even a subsidiary one, in gemmation. In fact, it has completely disappeared at the period when gemmation has only just commenced. In all probability it acts as a reserve for the young animal at the time when its nutrition is still null or insufficient.

On the Alternation of Generations.—If we desire to bring together as much as possible what takes place in the *Salpæ* and what occurs in *Pyrosoma*, we must take as equivalent terms, on the one hand, the agamic *Salpa*, and, on the other, the Cyathozoid. We have then, in the two cases, two asexual individuals producing by gemmation a whole series of individuals which differ from them in form, are alike, and sexual. The whole difference then lies in the fact that, while the sexual *Salpæ* cannot bud, the sexual *Pyrosomata* are capable of producing by gemmation other individuals, but similar to themselves.—*Comptes Rendus*, April 25, 1881, p. 1013.

Investigation of certain Points in the Anatomy of Sternaspis scutata.—Second Note *. By M. Max. Rietsch.

The vascular system of *Sternaspis* is very complex and interesting; it may be summed up by saying that it includes a dorsal vessel and a ventral system.

The dorsal vessel follows the stomach, upon which it rests, in all its contours; it is much narrower behind than in front of the bran-

* See 'Annals,' May 1881, p. 426.

chial anastomosis; this latter portion, which is at first wide, diminishes gradually to the commencement of the stomach; beyond this point it floats in the general cavity, but remains parallel to the œsophagus, to which it is attached by a few branches; finally it attaches itself to the pharynx, where it divides into numerous branches, the two principal ones forming a fork.

The ventral vessel has numerous roots at the ventral surface of the pharynx and the anterior setæ; it travels parallel to the nervous cord, to which it sends several branches, and emits numerous branches to the segmental organs, which will be mentioned further on; then, towards the middle of the body, it gives origin (1) to a vessel which follows forward the posterior intestine, (2) to two other trunks, the most voluminous of which soon divides into three. Thus are formed the four sexual vessels, upon which the generative organs originate. Three of them run along different portions of the stomach, the fourth along the recurrent intestine; they give origin to very numerous branches, which divide repeatedly and generally dichotomously, and finally open into a sinus lodged beneath the muscular layer of the intestine and against the vibratile furrow. The latter, in the stomachal region, is diametrically opposite to the dorsal vessel, which communicates with this longitudinal sinus by a very complex system of capillary canals, destitute of proper membrane, and placed between the muscular layer and the epithelium. The whole intestine is thus furnished with a very rich system of blood-sinuses, communicating with both the dorsal vessel and the ventral vessel along the pharynx, œsophagus, and stomach, but having direct connexion with the ventral vessel alone through all the rest of the intestine; there are, however, vascular anastomoses between the different intestinal regions.

Further back the ventral vessel emits numerous symmetrical branches, which run to the integuments, the posterior setæ, and the terminal intestine; some of them terminate posteriorly at regular racemes of ampullæ or pyriform bodies with thin walls placed between the shield and the rectum, and evidently forming a reservoir for the blood when that fluid is driven backward by the invagination and contraction of the anterior region of the body. I have been unable to detect any communication between these racemes and the branchiæ. The circulation seems to me to be due principally to the general movements of the body.

The generative organs are of the same form in the two sexes. The external appendages are followed by two oviducts or sperm-ducts, which run backward towards the median line, where they unite and at the same time adhere to the ventral vessel; each of them is accompanied by a sanguiferous branch, which is given off by this same ventral vessel, and which only quits them at the skin; from their point of convergence start the four lobes of the ovary or testis. These lobes are slowly formed along the four sexual vessels already mentioned; they possess each a *proper wall*, which is directly continuous with that of the oviducts, and in which the corresponding sexual vessel is enclosed. The ova originate upon the wall of this

vessel, which is turned towards the interior of the ovary, and at the expense of the epithelial cells forming that wall, to which, at first, they remain attached by a peduncle; they afterwards become detached, descend along the lobe, and then arrive in the oviducts; thus they never fall into the general cavity. The sexual lobes are of very unequal length in the same animal, and unequally developed in different individuals according to the age; in *Sternaspides* of large size, especially in the males, they present short secondary lobes along the principal branches of the sexual vessel.

In front of the oviducts and involved in the folds of the œsophagus, there exist two voluminous segmental organs ("four-horned organs" of Müller), of a brown colour, with delicate walls, irregularly lobed, and each furnished with an excretory canal, which becomes much narrowed towards the integuments, and opens outwards by an extremely small pore. The two symmetrical pores are placed in front of the genital appendages. I have not yet succeeded in detecting vibratile funnels in connexion with these organs; they present an internal epithelium and an external peritoneal layer, and between the two a rich network of often capillary blood-sinuses.

Hitherto I have only been able to observe the first phases of the embryogeny as the result of artificial fecundations. The ova are about 0·15 millim. in diameter; within their chorion, which usually retains a trace of the pedicle, they present a granular vitelline mass with an eccentric nucleus and a nucleolus; this nucleus disappears in the mature ova. The spermatozoids are from 0·085 to 0·10 millim. in length; the head is elongated, and occupies about one sixth of the entire length. The segmentation is complete; it commences about five hours after fecundation. Even the first two spheres are unequal; and the difference becomes rapidly more accentuated between the small hyaline evolutive cells and the large, dark, granular nutritive cells; the former quickly envelop the latter, and thus form a planula by epibolism. In four-and-twenty hours I found in the glasses pelagic larvæ composed of an ectoderm with small elements, and an endoderm formed of a few large brownish spheres; they appear to be destitute of both mouth and anus. These larvæ are covered with vibratile cilia, except in the posterior region; at their cephalic pole they bear a plume of longer cilia. But the pelagic life hardly lasts longer than from thirty-six to forty hours; the larvæ fall to the bottom of the water, lose their cilia, become elongated, and assume a vermiform appearance and movements. The evolution is afterwards very slow in the glasses; at the end of a month the larvæ, although considerably more elongated, present a digestive tube formed of large cells and destitute of mouth and anus; its cavity is filled with a liquid which bears numerous granules, and which the movements of the body cause to travel from before backward or *vice versâ*; in the posterior region and on the dorsal(?) surface we may distinguish a small ectodermal appendage bent into a hook, which may be the first rudiment of the branchiæ.—*Comptes Rendus*, May 2, 1881, p. 1066.